



# Northern New Mexico Math and Science Academy

## 2012 Evaluation Report

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## EXECUTIVE SUMMARY

It's a kind of synthesis, but with some elements that perhaps you wouldn't have expected in advance. I always like that when it happens, when something comes that is more than the sum of its parts. – *Evan Parker, British Jazz Musician*

This report presents findings of the 2011-2012 formative evaluation of the Northern New Mexico Math and Science Academy (MSA), an initiative of the Los Alamos National Laboratory. The primary objective of MSA is to provide high quality professional development (PD) in order to improve the teaching and learning of mathematics and science in northern New Mexico schools. The purpose of the evaluation is to document the extent to which goals and objectives of the program are being met and to identify any problematic aspects in order to enable continuous improvement of the program.

MSA's primary work has been in Española and surrounding communities, and it has provided mathematics and science PD to over 75% of teachers in the Española Public Schools. In 2012, MSA expanded to two schools in the Southern Pueblos Agency, Jemez Day School and San Felipe Elementary. The MSA team has designated the work in Española schools to be in its final stages, considered Phase 3. The work in the pueblos is in Phase 1, moving quickly into full implementation.

The MSA project provides comprehensive standards-based professional development for whole-school teams of teachers, principals, and support personnel. The programs include intensive summer institutes, content training in math and science, writing in mathematics, and follow-up coaching support throughout the year. In keeping with the program goals and mission, five questions drive the evaluation:

1. Do the MSA programs meet the five standards for high-quality professional learning? (Research suggests the five standards of best practice are: a content focus; duration over time; collective participation, cohesion, and active learning.)
2. To what extent did MSA participation influence teachers' beliefs, attitudes and content knowledge for teaching mathematics and science?
3. To what extent did MSA participation influence teachers' reported instructional practices?

4. To what extent has the MSA program had an impact on systemic reforms and capacity building for supporting the improvement of mathematics/science teaching and learning?
5. To what extent has MSA participation had an impact on student learning/achievement?

A multi-method design, including both qualitative and quantitative techniques, was used to address the evaluation questions. This design allows for triangulation, which increases confidence in and/or reliability of the findings from the evaluation. As part of the multi-method design adopted for this study, several types of data collection activities were conducted, including an on-line teacher survey, completed by 121 teachers; an on-line assessment of content knowledge for teaching mathematics; interviews with MSA teachers and principals; focus groups with teachers; and on-line teacher reflections. Together, these strategies allowed the evaluator to gain detailed knowledge about the MSA program design, the delivery of professional development, and the schools it serves.

Because Española schools and the Pueblo schools are in such different phases, they are each evaluated separately in the body of the report. In Española, the data is more summative, as the MSA projects wind down. In the Pueblos, the data is a benchmark against which future data can be compared. A synthesis of findings across projects is included, as well, and is summarized here.

## **Key Findings**

**Question #1: Quality of the MSA professional development programs.** MSA professional development is designed to incorporate five critical standards of high quality recognized as best practice (Desimone, 2009). The five standards include: a focus on content knowledge and pedagogy, duration and frequency of professional activities, active learning, collective participation that includes teacher teams, and coherence to curriculum and standards. All five standards of quality are evident in MSA programs.

***A focus on content knowledge and pedagogy.*** Triangulation of data from interviews, teacher reflections, and online surveys suggest that there is an intense focus on content, combined with training in how students learn the content provided in the Summer Institute, Math-Citement, Science-Citement, and the Ir-Rational Numbers Institute. A significant finding was that most teachers in the elementary schools have

very limited content knowledge for teaching mathematics and science, making the MSA focus on both content and how students best learn that content critical strategies for teachers to gain confidence and skills.

***Duration of the professional development.*** The MSA Core Institute provides teachers with over 126 hours of training (Española) and 146 hours of training (Pueblos), as well as sustained coaching support, each year for three years. Core Program participants indicate that this intensive support over time has been critical for building their content knowledge for teaching. Other MSA programs are also intensive and sustained, including the Ir-Rational Numbers Institutes (18 hours/semester) and Math-Citement and Science-Citement (30 hours/week). The programs provide teachers with the opportunity to be immersed in math/science content.

***Active learning.*** In the trainings, the MSA team models the inquiry strategies they are trying to encourage teachers to use with their students. Teachers are engaged in collaborative group problem-solving, in discussion, and in explaining their thinking. Teachers appreciate how strategies are being modeled in the training, but they want opportunities to see strategies and lessons modeled with their own students.

Coaching is also critical for teachers as they practice the strategies, coaching is important to support and guide teachers. One hundred percent of the teachers interviewed indicated that coaching was an important follow-up to the trainings. For one thing, it held teachers accountable for implementing some of the content and pedagogy they had experienced in their professional development sessions. “It made me try out the things that we learned in class” (MSA participant, Summer 2012). However, coaching consistency varied; MSA records indicate that the number of coaching visits and the coaching methods varied among participants.

***Collective participation.*** Teachers appreciated the opportunity to learn in teams of their peers during the PD sessions. They valued time to work collectively to learn content and strategies. The MSA team also strongly encourages teachers to continue their collaborative practice throughout the school year. The data suggests that this is working in schools where there is MSA facilitation with grade-level teams. However, without facilitation and guidance, “we don’t regularly get together and we don’t always know what to focus on” (3<sup>rd</sup> grade teacher, May 2012).

***Coherence.*** Teachers highly value professional development that is tied to the curricula they are expected to teach. MSA has emerged as “the only game in town” to support teachers in implementation of the math and science curricula. Without support, some teachers left the new science kits “sitting on the shelf” (MSA team observation, 2011). In response to this, the MSA team conducted several PD venues for Española teachers, including one-to-one and District-wide trainings. MSA has used the math and science curricula to immerse teachers in content and to model pedagogy.

This year, the MSA trainings have added the Core Curriculum State Standards, on which all New Mexico teachers are now expected to focus. State assessments will be based on these new standards, and teachers’ reflections indicate an appreciation for learning these standards in their MSA PD.

**Question #2: Extent to which MSA participation influenced teachers’ beliefs, attitudes and content knowledge for teaching mathematics and science.** Interview data, survey responses, and on-line reflections suggest that as a result of their participation in the professional development trainings, teachers felt more confident about teaching mathematics and science, felt more comfortable with the required curriculum, and indicated a change in their beliefs about mathematics and science instruction from a transmission approach toward an inquiry approach. Some teachers, particularly teachers from the Philippines, suggested that the MSA support had “rescued” them from leaving the profession. In addition, the vast majority of teachers felt that they had increased their content knowledge, become more interested in inquiry teaching, and learned strategies to engage students in mathematical reasoning and problem-solving. Teachers revealed that they were re-thinking their current teaching strategies to include more student-centered learning approaches in their classrooms.

**Question #3: Extent to which MSA participation influenced teachers reported instructional practices.** Participant teachers indicated that they had better classroom management and greater student engagement in math and science. They were more likely to employ instructional strategies that allows students to discuss problem-solving strategies, use games and manipulatives, and interact with each other and ask more questions. Interviews with math coaches and principals indicated that the trainings provided by MSA supported teachers in fully implementing the math and science

curricula, and in involving students in small group work to share problem-solving strategies and explain their thinking. Participant teachers also are using new strategies to have students write in mathematics and keep a scientific notebook.

**Question #4: Extent to which MSA has helped schools and districts to focus on systemic reforms and capacity building for supporting the improvement of mathematics/science teaching and learning.** There is substantial evidence that MSA has contributed to the Española schools' capacity to sustain the efforts toward improving the teaching and learning of mathematics. There is evidence of increased capacity for sustaining the support for and focus on inquiry mathematics and science teaching in four important areas: 1) school-based teacher collaboration focused on student work in at least 5 schools, 2) MSA-trained school instructional coaches and teacher leaders leading district-wide professional development for the Española district, 3) principals are now using the MSA GANAS form for classroom observations, and 4) over forty Española MSA participants have achieved post graduate degrees in teaching math and science.

***Teachers are more collaborative.*** Interview data and the online survey indicate that as a result of the MSA professional development, teachers have become more collaborative in their schools. In those schools where a majority of teachers and the principal have had MSA experience, professional learning communities (PLCs) around math and science have become the norm. In these schools, teachers meet on a regular basis to share their strategies, lesson plans, and student work. Principals in these “majority MSA” schools play an active role in providing the necessary support to teachers.

***MSA-trained coaches and teacher leaders are taking on science and math PD for the district.*** Beginning in the fall of 2012, all district-wide math and science professional development is being planned and provided by MSA-trained coaches and teacher leaders. Coaches are feeling “better equipped” to support teachers in math and science teaching because of their MSA training.

***Principals are using MSA's GANAS forms for observations.*** MSA's GANAS form is designed to guide classroom observations and discussions about teaching practices. The district has adopted this form to structure and guide principals as they observe mathematics and science lessons. The GANAS form aligns with the mathematics

curriculum and informs the way teachers are supposed to structure their lessons.

***Educators have more university training focused on mathematics and science.***

Since 2005, 57 of MSA participants have earned a Master's degree at NMSU in Teaching Mathematics and Science. Additionally, eight educators affiliated with the MSA are participating in a doctoral program in Educational Leadership at UNM with an emphasis on Rural Leadership and Education.

**Question #5: Extent to which MSA participation has had an impact on student achievement.** There are a number of moderating variables<sup>1</sup> that contribute to how and whether students learn math and science, making it unreliable to find a direct link between MSA professional development and student learning outcomes. Standardized measures of student achievement include once-a-year standards-based assessments and a short-cycle assessment, which are not the best indicators of individual student achievement. However, there is quantitative data to suggest that student scores in Española schools, where MSA has focused its efforts in the past several years, are improving. While the scores are below state averages, there has been steady improvement. Additionally, students in schools where MSA has had a significant presence are doing better on short-answer and open-ended response questions. It will be important to continue to seek measures for student learning. Triangulating data from the MSA participation lists, teacher interviews, and the MAP short cycle assessments revealed that there is no correlation between the amount of time a teacher spends in MSA and average student gains. However, there is a positive correlation between teacher involvement in MSA and students' ability to express their mathematical thinking in writing.

**Moderating variables and challenges that may impact results of MSA programs.**

There are a number of variables in this study that have potential effects on the relationship between MSA professional development activities and teacher efficacy.

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<sup>1</sup> A moderating variable represents a process or a factor that alters the impact of an independent variable X, like professional development, on a dependent variable Y, such as change in teachers' instructional practices and student learning.

Potential moderating variables include such things as school and district policies, mobility, principal instructional leadership, and teacher motivation. These are discussed more fully in the body of the report.

## **Recommendations**

The following recommendations for the MSA program were derived from the findings of the evaluation:

1. Continue to provide intensive, sustained, content-focused professional development that emphasizes mathematics and science content knowledge for teaching and teacher collaboration.
2. Work with school leaders to generate a support and monitoring process at the classroom level to ensure that teachers are implementing the strategies learned at the MSA training sessions.
3. Continue to train school instructional coaches to support teachers in implementing the strategies learned in MSA trainings.
4. Measuring change in teacher practice is challenging, and would require the MSA team to generate an observation protocol based on the strategies emphasized in the trainings that both observers and those teaching the lesson can use to reflect on the lesson. Determine the value of such a protocol in informing the program evaluation. Consider ways such a protocol might assess changes in teacher practice.
5. Continue to have participants take the online survey and the Learning Mathematics for Teaching assessment in the Summer Institute. They provided valuable data about impact on teacher's knowledge, beliefs and attitudes about the teaching and learning of math and science.
6. Consider alternative data sources for evidence of impact of MSA professional development on teachers' instructional practices, and ultimately on student learning.
7. Provide opportunities for teachers to observe math and science inquiry lessons first-hand. This could be done in any of three ways: 1) model lessons with their students; 2) facilitate ways for teachers to observe in other classrooms, along with follow-up reflections; 3) video-tape teachers' lessons and follow-up with reflective discussion.
8. Train teachers how to run meaningful professional learning communities (PLCs) that focus on pedagogy and student work. High quality PLCs take time and expertise.